

Physics 321, Autumn Quarter 2015

Electrodynamics: Homework Assignment 5

(a) Turn in all problems and clearly note all constants and assumptions you use.

(1-point penalty each otherwise)

(b) Use 8½ x 11 paper & staple

(1-point penalty each otherwise)

Due 9:30 am Thursday November 5

1. Consider a conducting plate suspended above a ground plane at potential V_0 and distance above the ground plane d . Use Laplace's Equation to find the potential between the plates. Assume no fringing fields.

2. Challenge problem. Consider a sphere of radius R with point charge Q at the center and no other charges in the problem. The electrostatic potential on the sphere surface is $V(\theta) = V_0 \cos\theta$, with θ the polar angle. (a) What's the electrostatic potential outside the sphere? (b) What's the electrostatic potential inside the sphere?

3. Consider a long wire of radius R . The wire has charge per unit length λ . The wire is suspended a large distance d above a ground plane. What's the capacitance per unit length? Hint: Image wire.

4. Point charges $+Q$ at $x=a, y=0, z=a$ and $-Q$ at $x=-a, y=0, z=a$ are suspended above a ground plane at $z=0$. Find (a) the force on $+Q$, (b) the work needed to assemble this system of point charges above the plane, (c) the surface charge density σ at $x=a, y=0, z=0$.